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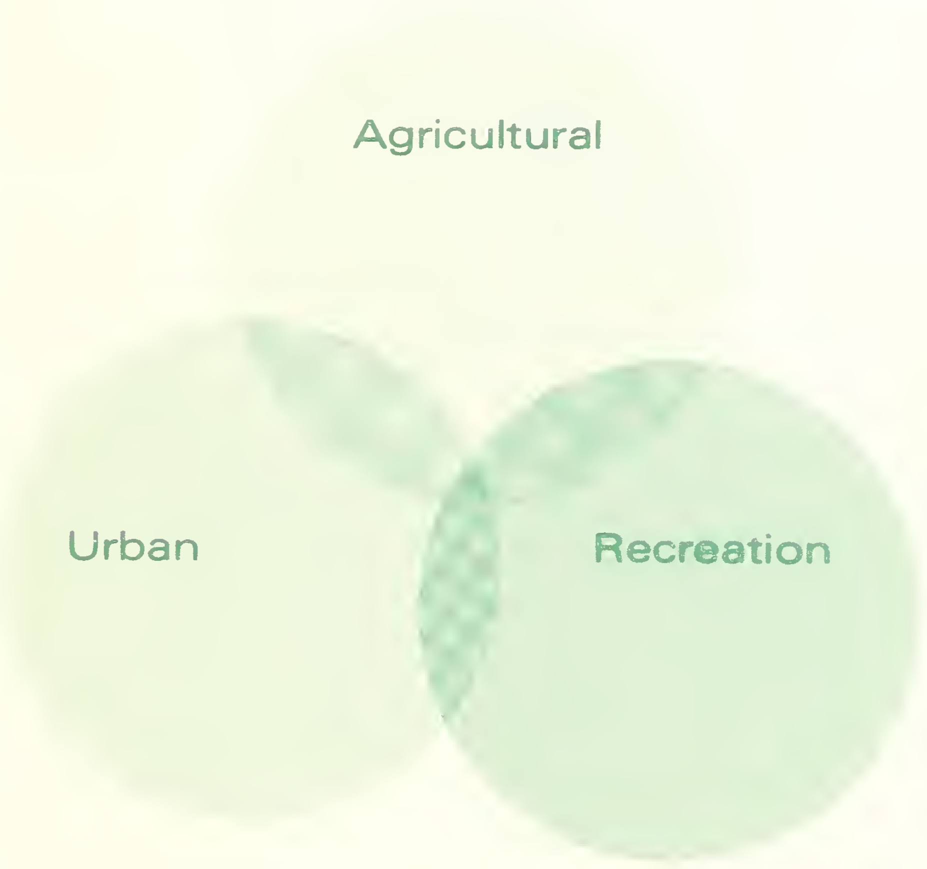
FARMLAND USE VALUES VERSUS MARKET PRICES

in Three Oregon Land Markets



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ABSTRACT

Analysis of 339 farmland sales in three areas of Oregon during 1965-69 showed that in each area, factors in addition to net rent income influenced prices paid. Corresponding property characteristics also varied in importance among areas in explaining differences in per acre prices paid.

Values of six property characteristics were obtained for each sale—year of sale, acres in sale, building value per acre, miles to nearest paved road, miles to nearest town of at least 1,000 population, and landlord net real estate income per acre.

Based on significant differences in the importance of property characteristics on prices paid and the apparent differences in motives for transactions among these areas, it was concluded that each area constituted a separate land market.

Net rent-to-land price ratios varied from 4.3 percent in the dryland grain area to 2.8 percent in urban influenced Marion County to 1.0 percent in urban-recreation influenced Douglas County. But because of the variability of rent-price ratios for individual properties within each area, a disparity between the farm use value and market price of farmland was concluded to exist only in Douglas County.

Keywords: Land values, farm real estate, land transfer, regression analysis, rent, returns, Oregon.

PREFACE

The primary purpose of this report is not to distribute land value data per se. Rather, it is to demonstrate techniques for analyzing farm real estate market relationships. Data used in this report are from sales of farmland in Oregon during 1965-69. These data can be replaced with land sales data from other locations and time periods, however, to analyze farm real estate market relationships in a different setting.

The author gratefully acknowledges the assistance received throughout this study from Professor Grant E. Blanch (thesis advisor), the Oregon Department of Revenue fieldmen and county personnel in the three study areas, and the Agricultural Stabilization and Conservation Service personnel in the three dryland grain area counties. Professors William G. Brown, Emery N. Castle, Roger G. Peterson, and Warren E. Kronstad also offered helpful comments and assistance during the study.

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SUMMARY

Nonagricultural factors and non-income motivated factors apparently influenced farmland prices in all three types of agricultural areas in Oregon for which analysis of farmland sales during 1965-69 was made.

However, nonagricultural motives for owning land appeared to be more important than the traditional farmland ownership motive—realization of net income—in only one study area. A disparity between the market value and farm use or productivity value of land existed only in the urban-recreation influenced area in southwest Oregon (Douglas County). The average rent-to-land price ratio on farmland investments was also low in urban influenced Marion County in the populous Willamette Valley south of Portland, and was only modest in the dryland grain area in north-central Oregon. But rent-price ratios for purchases in both these areas were so variable that a disparity could not be concluded to exist between the market price and farm use value of farmland in either the grain area or Marion County.

Six property characteristics were of varied importance in explaining differences in land prices among areas studied. The value of each of the six characteristics was determined for each property transaction included in the sales analyzed in the three study areas. The characteristics were: year of sale, acres in sale, assessed value of buildings per acre, miles to nearest paved road, miles to nearest town of at least 1,000 population, and landlord net real estate income per acre.

When simple regression analysis was used to analyze sales in each area (each property characteristic or independent variable was correlated individually with sale price per acre, the dependent variable) only the size and income characteristics were significant in all three areas. Another characteristic, "miles to nearest paved road," was indicated not to be significant in explaining differences in land prices in any of the three areas.

When a multiple regression analysis routine was used to analyze the same data, different results were observed. This alternative statistical technique analyzed simultaneously the impact of all property characteristics on sale price per acre. With this technique, only the variable "assessed value of buildings per acre" was significant in each area. "Acres in sale" remained significant only in the grain area and in urban influenced Marion County. The income variable remained significant in the grain area and in urban-recreation influenced Douglas County, but not in urban influenced Marion County. Although the average net rent-to-land price ratio was not significantly different from the assumed prudent-investor rate of return (6 percent), the income variable in the multiple regression model did not explain much of the variable in land prices in this area.

Changes in the value of the six property characteristics generally had the expected impact on property prices. For example, the more recent sales had higher predicted prices per acre and the larger acreage tracts had lower predicted prices. The only unexpected sign that was statistically significant was the positive sign on the "miles to the nearest town of at least 1,000 population" variable in the grain area. The 0.89 value of this simple regression coefficient indicated that a 1-mile increase in the distance to a town of 1,000 would increase sale price per acre $0.89. This unexpected result occurred because the higher producing and, consequently, higher priced grain land was located further from towns of at least 1,000 population.

Rates of land price increase and rent-price ratios implied by the regression coefficients on these variables are also interesting. The annual rate of change in property values implied by the *simple* regression coefficients varied from no significant change in the grain area to over 14 percent in Douglas County and over 12 percent in Marion County. The annual rent-price ratio implied by the simple regression coefficients was 5.1 percent in the grain area, 1.7 percent in Douglas County, and 9.7 percent in Marion County. Rates of price appreciation and rent-price ratios implied by *multiple* regression routine coefficients correspond fairly closely with those implied by the simple regression routine coefficients—with one exception. The exception was the -0.51 coefficient value on the income variable in Marion County. This value indicated that a $1 increase in net rent, assuming all other factors remained constant,

would result in a $0.51 decrease in land value. This value was not significantly different than zero, however, so the implied rate of return was not calculated for the purpose of comparison.

The three areas studied appear to constitute at least three separate land markets, as evidenced by the apparent differences in motives underlying land transactions in these areas.

FARMLAND USE VALUES VERSUS MARKET PRICES IN THREE OREGON LAND MARKETS

William D. Crowley, Jr.[1]

INTRODUCTION

Farmland Use Values Versus Market Prices

The apparent and growing disparity between the farmland use value and current market price of agricultural land is of wide concern. Agricultural property owners have been particularly vocal on this issue. It is also important to mortgage lenders, prospective land buyers, taxing authorities, agricultural policymakers, and others because it indicates a knowledge gap—an inability to explain the difference between the expected and the observed with confidence. This situation presents problems to those who must make decisions concerning future events, such as repayment capabilities, market value of land, and net farm income.

"From a theoretical point of view, the value of any productive land resource always equals the sum total of its future economic rents discounted back to the present" (1, p. 169).[2] For example, the present value of an annual net land income stream of $30 per acre when discounted at 6 percent would be $500 per acre, assuming that the level of net rent remains unchanged over time.[3] If this property sells for more than $500 per acre, then a disparity between its farm use value and its current market value is said to exist.[4] The frequency and magnitude of such disparities perplexes those interested in farmland value levels and trends.

Suggested Explanations for Disparity

Several reasons have been advanced to explain why farmland sells for more than its farm use or productivity value. Prices paid for many agricultural properties near population centers probably reflect increased value from actual or potential use as home or business sites. Similarly, prices paid for agricultural properties near recreation sites probably reflect the limited supply of land near specific recreation sites.

Even in areas that appear to be unaffected by nonagricultural influences, prices paid for a large percentage of agricultural properties seem to be higher than their farm use values. A frequent explanation for this is that most farm properties purchased are operated with land already owned or leased. And land buyers feel justified in paying more per acre for add-on units than for complete units because at least some of the management, machinery, and labor costs in operating a farm or ranch are fixed and can thus be spread over more acres. The result is a lower rate of return realized on add-on purchases. Prices in excess of the implied farm use value for add-on properties also affect prices paid for complete units because property owners have the option of selling their property as one unit or as two or more parcels. People who want to purchase complete units must compete (at least indirectly) with those who want to purchase add-on units. The result is higher prices for farm properties and, thus, lower rates of return.

Other buyers, even in primarily agricultural areas, may derive considerable psychic income from living in, working in, and raising families in rural areas. These people seem willing to accept an apparent low rate of return as a result of having paid a high price for the right to amenities associated with rural living.

In addition, fairly steady increases in land values may cause buyers to expect the trend to continue. These

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[1] National Economic Analysis Division. The author's Ph.D. research (*3*) provides the basis for this report.

[2] Numbers in parentheses refer to items in References.

[3] "The capitalization formula used in the computation of land values can be expressed as:

$$V = \frac{a}{(1+r)^1} + \frac{a}{(1+r)^2} + \frac{a}{(1+r)^3} + \cdots + \frac{a}{(1+r)^n}$$

and reduces to $V = a/r$. In this formula V= value of the property, a= average annual economic rent, and r = the capitalization rate" (1, p. 169). This formula assumes that "a" and "r" are constant and known with certainty over the "n" time periods.

[4] If the prevailing prudent-investor rate of return were 8 percent (which implies that prudent investors discount the value of future income more heavily than if a lower rate prevailed), then any sale price above $375 per acre would result in a disparity.

people may treat anticipated increases in land values as deferred income and thus pay more for land than those who consider annual net rent as the only source of return—a point to be developed later in this report. Other reasons for the disparity have been advanced but were not pursued in this study.[5]

Each of these suggested explanations or hypotheses may be valid for explaining the apparent disparity for some transfers. And each may be of particular importance in one or more areas. However, comparative analysis of farmland transfers in agricultural areas believed to be variously influenced seems necessary to test whether a disparity exists. If numerous land markets exist, as Barlowe (*1*) and Scofield (*8*) suggest, then the importance of selected property characteristics in influencing real estate prices should vary among areas analyzed.

FOCUS ON FARMLAND SALES DATA

The specific interrelated objectives of this study are:

1. To determine if a disparity exists between the farm use value and current market value of farm property transfers in any agricultural area analyzed.
2. To determine the relationship between prices of sales analyzed and characteristics of these sales within each area selected for analysis;
3. To determine if there is a significant difference in the influence of net real estate income and other individual property characteristics on property prices among areas; and
4. To investigate whether variously influenced agricultural areas actually constitute separate land markets.

VARIOUS AGRICULTURAL LAND MARKETS POSTULATED

Several approaches were considered to analyze the apparent disparity between farm use values and current market values of farm properties.[6] Three variously influenced agricultural areas in Oregon were selected as study areas. One was primarily an agricultural production area with only minimal nonagricultural influences, another was close to a population center and thus subject to pressures from urbanization, and the third was in an outdoor recreation influenced area. Data on the same property characteristics were gathered from each of a sample of farmland transfers in each area. By using a multiple regression routine to analyze sales data, the importance of net land income and other selected characteristics in explaining differences in property prices was compared among areas.

By including net land income as one property characteristic, both the importance of this variable in influencing property prices in an area and the mean rate of return on the purchase price of property in an area can be determined. By comparing the mean rate of return determined for transfers in each area with a rate selected as representative of a prudent-investor rate of return, one can test whether a disparity exists in any of the areas selected. By comparing the importance of net land income and other property characteristics among areas, one can also test the theory that numerous farm real estate markets exist.

Conceptualization of the Farmland Market

Some analysts believe that farmland transfers occur in a single, large, undifferentiated market. Others suggest that a number of smaller markets or areas, each with more homogeneous properties, may provide a better analytical framework. In this study transfers are examined as if they occur in variously influenced agricultural land markets.

Figure 1 portrays the agricultural land markets considered in this study. The large rectangular area, labeled U, represents all privately owned land. The area inside the circles represents agricultural, urban, or recreation influenced land. Some privately owned land may be subject to influences other than those specified in the circles. This land acreage—which could include factory sites, waste land, and so forth—is represented by the area

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[5] Two other often-mentioned reasons: Many purchases are at least partially motivated by income tax avoidance considerations, so excluding tax savings from the property's income stream understates the rate of return; and farm real estate purchases present the opportunity to control an asset with a moderate downpayment, thus basing the rate of return on the purchase price rather than on the investor's equity also understates the rate of return on leveraged investments.

[6] The most straightforward approach considered was simply to compare the mean rate of return on the purchase price of a sample of transfers in an area with a rate selected as representative of a prudent-investor rate of return. This approach would have tested for a significant difference between the determined rate of return and the selected prudent-investor rate of return for one area. But it would not have allowed for comparison of mean rates of return for specific categories of transfers selected from an area, or for the determination of the importance of any property characteristic other than net land income in influencing property prices in even a single area. A second approach considered was to collect data on comparable property characteristics from a sample of farmland transfers in selected agricultural areas in two or more States. This approach would have allowed for comparison of results among study areas. But since each State has its own procedures for verifying and documenting land transfers, considerable time and effort would have been required to collect comparable data in each area.

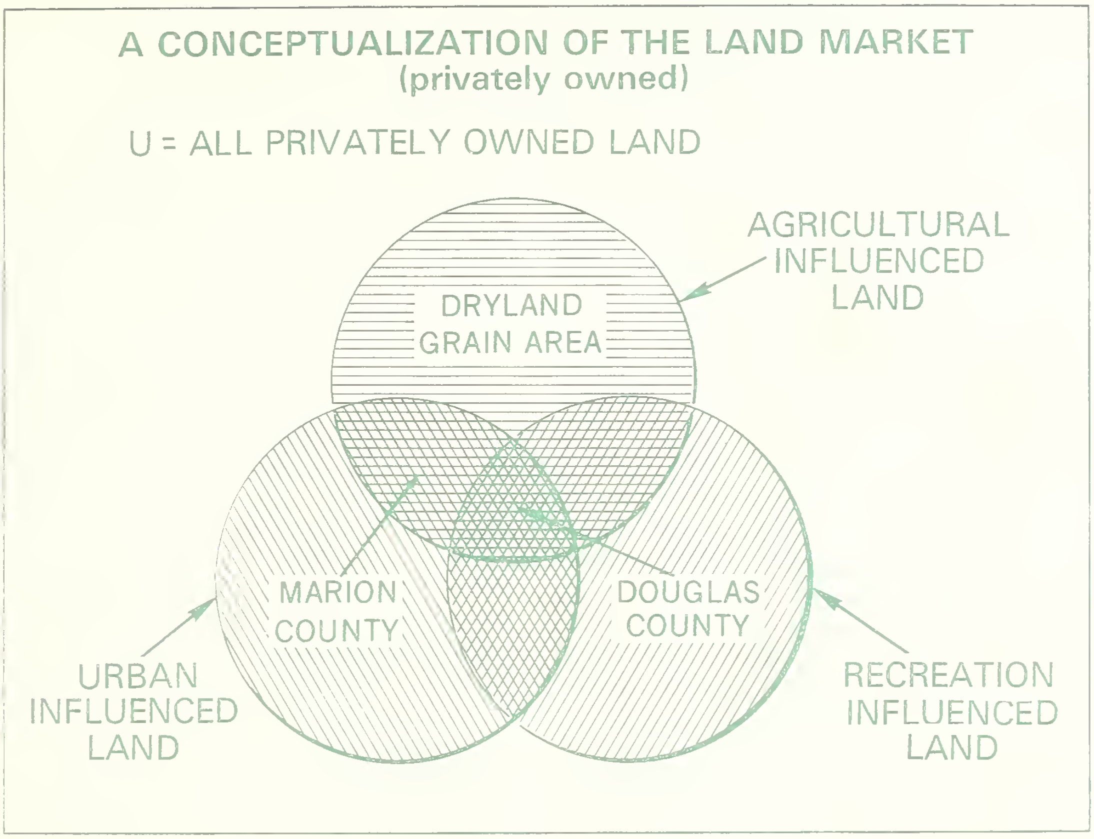
A CONCEPTUALIZATION OF THE LAND MARKET
(privately owned)
U = ALL PRIVATELY OWNED LAND
AGRICULTURAL INFLUENCED LAND
DRYLAND GRAIN AREA
MARION COUNTY
DOUGLAS COUNTY
URBAN INFLUENCED LAND
RECREATION INFLUENCED LAND

Figure 1

in the rectangle situated outside the circles. Within the confines of a single circle, there are four areas—each assumed to represent variously influenced land. The area represented by the overlap of "agricultural influenced land" and "urban influenced land" has a very observable counterpart in reality—the fringe areas around population centers. The area represented by the overlap of "agricultural influenced land" and "recreation influenced land" includes cultivated and pastureland near forests, swamps, oceans, lakes, rivers, or other areas suited to recreation activity.[7] The area having the fewest real-world examples would be overlap between "urban influenced land" and "recreation influenced land." Disneyland and some "Frontier Towns" are examples of such properties. The fourth area includes the overlap of all three types of influenced areas, and is thus classified as an urban-recreation influenced agricultural area. The best example of properties in this type of influenced area are sidehill and mountainous grazing tracts near towns. Prices of these properties are likely to be influenced by buyers interested in rural residences and those interested in using rural land in recreational pursuits.

Agricultural Study Areas Selected

A total of 339 farmland sales in three areas of Oregon were analyzed. The areas are: a predominately agricultural production area having only minimal nonagricultural influences, an urban influenced area, and an urban-recreation influenced area. A recreation influenced agricultural study area was not selected because there was an insufficient number of farmland transfers in each area considered as a possible recreation influenced study area.

The agricultural production area encompasses the dryland grain portions of three contiguous counties in northcentral Oregon—Sherman, Gilliam, and Morrow counties (fig. 2). The urban influenced area is Marion County, in the productive and populous Willamette Valley in northwestern Oregon. The urban-recreation influenced area is Douglas County, in the mountainous southwestern portion of Oregon.

The dryland grain area appears to constitute basically an agricultural production land market only minimally

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[7] For lack of a more descriptive term, "recreational" use refers to the traditional outdoor recreational activities plus the enjoyment of land ownership and use as a means to obtain freedom from congestion, a "view," proximity to recreational sites off the property, a "quality environment", and so forth.

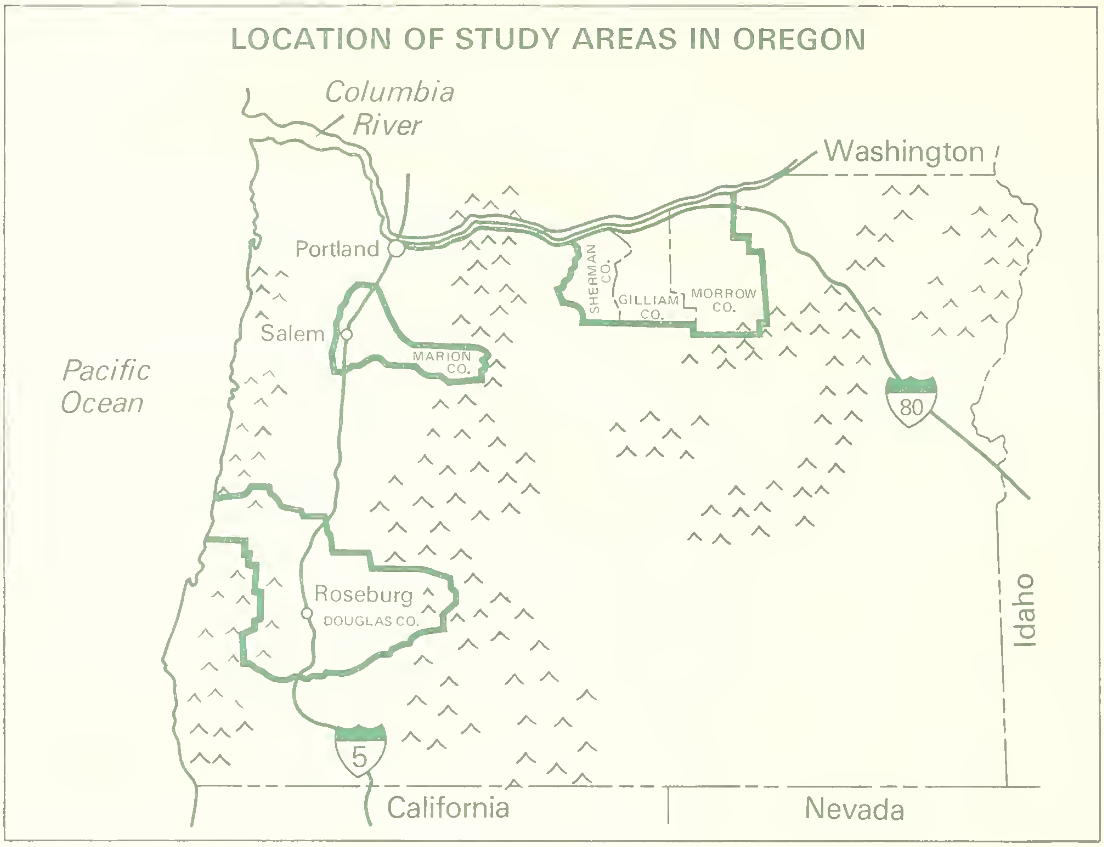

Figure 2

influenced by nonagricultural influences. Most of the land transferred was by retiring operators or by heirs of operators. Most of the purchases were by local farmers who planned to operate the land in conjunction with land owned or leased. Agricultural income generation appeared to be the primary motive for purchase, although expectation for capital appreciation over the medium to long run was probably a secondary motive for many.

In Douglas County, on the other hand, land prices appear to be heavily influenced by nonagricultural factors. Even though most land in this area is used in some agricultural capacity (grazed, hayed, cultivated, or in orchard crops), agricultural income generation seems far from the dominant motive for property ownership. Douglas County is bordered on the west by the Pacific Ocean and on the east by National Forest. Most of the county is mountainous, but some highly productive cultivated cropland and orchard land is located in the smaller valleys along the rivers draining this area. Most of the population is in a few small towns along Interstate 5–the major route between San Francisco and Seattle. The area abounds with panoramic views of unspoiled scenery and has been exposed to millions of travelers.

Purchases selected for analysis in Douglas County were limited to those of at least 20 acres to minimize the number of strictly rural homesite purchases. However, the extremely low average rent-to-land price ratio for tracts indicated that factors other than agricultural rent income motivated most purchases. Two major factors appear responsible. First, esthetic qualities of the property and the surrounding environment probably provided non-monetary benefits to many purchasers of land for part-time farms and rural acreages. Second, prospects for rapid land price increase due to increasing demand for rural real estate for nonagricultural production uses and, as a result, realization of capital gains at the time of sale were likely considered a source of income to many investor-purchasers. Many of the properties were purchased by people who moved from larger communities in Oregon and nearby States, particularly California. Many of the properties sold were by those who purchased properties several years earlier as investments.

Marion County, while categorized as an urban influenced area, appears to be a composite of several types of land markets. Thousands of acres in the county are sufficiently productive to justify prices currently paid for farmland from agricultural rents. Other acreage on ridges and sidehills, especially view properties within commuting distance of employment centers, have very low and even negative rent-to-land price ratios. Still another type of land market appears to exist close to growing population centers, where the investor-purchaser often rents out land to offset part of his cost of holding the land until it is converted to a nonagricultural use. Investors are willing to accept low and even a negative cash flow from rents if sufficient price appreciation and, in turn, capital gains at time of sale are anticipated.

MODEL ANALYZES REAL ESTATE TRANSFER DATA

Several property characteristics in addition to net land income are believed to influence transfer prices of farm real estate. But each characteristic is not believed to influence property prices to the same extent in variously influenced areas. For these reasons, a multi-variable regression model was used to analyze real estate transfer data in each study area. The same model was used in each study area so that more valid comparisons of the importance of similar characteristics among areas could be made. Thus, the model can be referred to as a multi-area model.

The general form of the model can be written:

$$
\begin{aligned}
Y' &= b'_o + b'_1 X_1 + b'_2 X_2 + \cdots + b'_p X_p \\
Y'' &= b'' + b''_1 X_1 + b''_2 X_2 + \cdots + b''_p X_p \\
Y''' &= b'''_o + b'''_1 X_1 + b'''_2 X_2 + \cdots + b'''_p X_p
\end{aligned}
$$

The model is composed of three separate but identical equations, one for each study area.

The Y term (dependent variable) in each equation refers to the estimated per acre price of a farm property in each area. Each X term (independent variable) refers to one of the p selected property characteristics. The b terms (net regression coefficients) associated with the property characteristics relate the impact of a one-unit increase in the value of any property characteristic to the per acre value of property in the particular area.[8] The size of all other property characteristics is assumed to remain unchanged. For example, a b'_1 value of 3.5 means that if the X_1 variable in the first area were increased by one unit, price per acre would increase $3.50.

VARIABLES WHICH MAY INFLUENCE FARMLAND SALES

The model is a simplified version or abstraction of reality. To include all factors that may influence farmland prices in one model would make the model complicated and expensive to use and might, in fact, reduce the usefulness of the model in showing why land prices differ among areas and over time. For this reason only six variables were selected for use in analyzing farmland sales. Each property characteristic was believed to be an important determinant of value in at least one study area. However, each variable was used in all three areas; that is, measurements of these six variables were made on every sale to compare the importance of the property characteristics selected among areas.

The six property characteristics or independent variables selected were: year of sales (X_1), acres in sale (X_2), assessed value of buildings per acre (X_3), miles to nearest paved road (X_4), miles to nearest town of at least 1,000 population (X_5), and landlord net real estate income per acre (X_6). The dependent variable used was real estate (land and buildings) sale price per acre (Y).

Three criterion were established for use in selecting the independent variables. The first criterion was that corresponding data were available on the characteristic in each area. This criterion precluded use of some variables, such as yields of specific crops and percentage of land that is tillable or tilled, because comparable data may not have been available in all areas or may not have provided meaningful comparisons among areas. A variable to account for recreational attributes of tracts was not included due to the difficulty of defining and measuring such attributes.

The second criterion was that each variable be important in influencing property prices in at least one area. Variables such as miles to paved road (X_4) and miles to nearest town of at least 1,000 population (X_5) were thought to be important influences on property prices in the urban influenced area—and perhaps in the urban-recreation influenced area—but not in the basic agricultural production area.

The third and final criterion used in selecting independent variables for the model was confidence that the variables were in fact independent. That is, change in the level of one independent variable was assumed to be associated with change in the level of the dependent variable (real estate sale price per acre) only and not with change in the level of any other independent variable. For example, in the grain area both wheat yields and net real estate income per acre were expected to explain much of the difference in per acre prices of grain tracts. But since these two "independent" variables were thought to be closely interrelated, only the latter was included in the model.[9]

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[8] The b_o term is a constant, so, loosely speaking, it can be interpreted as the per acre value of farm real estate when the values of all property characteristics in the model are zero.

EFFECT OF VARIABLES ON PROPERTY VALUES DIFFERS AMONG STUDY AREAS

After sale price per acre and the values of the six property characteristics were determined for each sale included in the sample in each area, the sales data were analyzed statistically. Multiple linear regression analysis was the primary statistical technique used. But a simple linear regression analysis was also used—to analyze the relationship between sale price per acre and each independent variable individually, and to compare results obtained from analyzing the same data with different regression techniques. Both statistical techniques showed that considerable variation existed in sales data, both within and among areas, and that the influence of corresponding property characteristics on property values also varied considerably among areas.

Mean Value of Sale Prices and Real Estate Characteristics by Area

In addition to solving for net regression coefficient values (the b terms associated with the independent variables), the multiple regression routine solved for other values. The other values were the average (mean or weighted average) sale price per acre and the average value of each of the real estate characteristics.[10] These values are shown in table 1. As expected, the average sale price per acre differed considerably among areas, as did the average value of corresponding property characteristics.

Average price per acre was expected to be highest in Marion County—the most densely populated and most urban influenced area. The price of farm real estate sales analyzed averaged $645.80 per acre in Marion County, $105.69 in the dryland grain area, and $237.32 in Douglas County (the urban-recreation influenced area).

The average size of the property characteristics in Marion County reflected the strong urban influence. Compared with farm property transfers in the other areas, sales in Marion County were small, well improved, situated close to paved roads and towns, and agriculturally productive.[11] Price per acre and every property characteristic except income per acre was lowest in Douglas County even though sale price per acre in this area was more than double that in the grain area.

Average Earnings-Price Ratios by Area

Net real estate income per acre was considerably higher in Marion County ($18.31) than in either the grain area ($4.52) or Douglas County ($2.33). However, the earnings-price ratio was highest in the grain area (4.3

Table 1.—Mean value of sale price per acre and real estate characteristics, by area

Sale price per acre or real estate characteristic	Grain area	Douglas County	Marion County
Y (real estate sale price, $/acre, land and buildings)	105.69	237.32	654.80
	[1](41.34)	(213.75)	(370.44)
X_1 (year of sale, 1965=5,...,1969=9)	6.59	6.60	7.07
	(1.45)	(1.33)	(1.06)
X_2 (acres in sale)	846.08	343.61	51.50
	(907.86)	(595.77)	(55.41)
X_3 (assessed value of buildings, $/acre)	2.09	36.23	127.76
	(4.31)	(52.74)	(173.57)
X_4 (miles to nearest paved road)	2.02	0.82	0.23
	(2.22)	(1.43)	(0.37)
X_5 (miles to nearest town $\geqslant$ 1,000 population)	21.91	7.93	5.89
	(16.20)	(5.55)	(2.74)
X_6 (landlord net real estate income, $/acre)	4.52	2.33	18.31
	(1.70)	(2.47)	(12.15)

[1] Numbers in parentheses are standard deviations of the means.

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[9] For a discussion of the effect of increasing levels in intercorrelation on the reliability of individual regression constants, see (5, pp. 256-8).

[10] The simple correlation coefficient values also solved for are shown in appendix A. These values are a measure of the interrelatedness of all possible pairings of the variables, including the dependent variable.

[11] The 7.07 value for the year of sale variable signifies that the average year of sale was 1967.07. This was slightly over the midpoint of the 1965-69 period considered and indicates that sales in Marion County were, on the average, one-half year more recent than sales in the other two areas. Since property prices increased briskly in Marion County over this period, higher property prices in this area are partly attributable to a higher percentage of more recent sales.

percent), followed by Marion County (2.8 percent) and then by Douglas County (1.0 percent).[12]

The very modest earnings-price ratio in Douglas and Marion Counties suggests that farmland prices in these areas are strongly influenced by nonagricultural factors. This generalization is supported by results from analyses of sales using both simple and multiple linear regression.

Simple Regression Coefficient Values

A scatter diagram is often used to visually portray the relationship between two variables, such as height and age or years of education and annual salary. The line of best fit through the dots in the scatter diagram is the regression line.[13] The slope of the line is given by the simple regression coefficient value. That is, a coefficient value of 20 would indicate that each 1-unit increase in the value of the variable on the horizontal axis would be associated with a 20-unit increase in the value of the variable on the vertical axis. The previous example is often used to represent the relationship between net land income and land price—each additional dollar of net rent would be associated with an additional $20 of land value.

Table 2 shows the simple linear regression values for each of the six property characteristics for each area. Each value that is significantly correlated with sale price per acre at the 5-percent level of probability is shown with an asterisk.[14] Of the 18 values (three areas with 6 variables each), only 7 are not significantly different from zero; that is, the slope of the regression line is not significantly different than horizontal.

Five of the seven nonsignificant values are associated with the two distance variables. Surprisingly, miles to the nearest paved road (X_4) was not significant in explaining variation in sale price per acre in any area. And miles to the nearest town of at least 1,000 population (X_5) was significant only in the grain area. However, because the more productive, higher-priced land in the grain area was located further from towns of at least 1,000 population, the sign of the value was unexpectedly positive—implying that real estate value per acre would increase as distance to a town of 1,000 increased.

Acres in sale (X_2) was a significant variable in each area. A 1-acre increase in tract size would result in an average decrease in sale price per acre of $0.02 in the grain area, $0.10 in Douglas County, and $1.88 in Marion County.

Net real estate income per acre (X_6) was also a significant variable in each area. A $1 increase in net real estate income per acre would result in an average increase in real estate price per acre of $19.33 in the grain area, $56.88 in Douglas County, and $10.29 in Marion County. Or, interpreting these values somewhat

Table 2.—Simple regression coefficients, standard errors of simple regression coefficients, and coefficient of determination values, by area

Real estate characteristic	Grain area	Douglas County	Marion County
X_1 (year of sale, 1965-69)	-3.02	33.92**	79.01*
	(3.34)	(13.07)	(31.61)
r^2 (percent)	1.13	4.47	5.07
X_2 (acres in sale)	-0.020**	-0.10**	-1.88**
	(0.005)	(0.03)	(0.59)
r^2 (percent)	19.55	7.07	7.91
X_3 (assessed value of buildings, $/acre)	0.55	2.68**	1.41**
	(1.13)	(0.25)	(0.15)
r^2 (percent)	0.33	43.61	43.39
X_4 (miles to nearest paved road)	-0.47	6.78	-139.23
	(2.20)	(12.46)	(92.46)
r^2 (percent)	0.06	0.20	1.90
X_5 (miles to nearest town $\geqslant$ 1,000 population)	0.89**	-0.61	-9.66
	(0.28)	(3.21)	(12.46)
r^2 (percent)	12.06	0.03	0.51
X_6 (landlord net real estate income, $/acre)	19.33**	56.68**	10.29**
	(1.75)	(5.44)	(2.65)
r^2 (percent)	62.84	42.95	11.40

*Statistically different from zero at 5-percent level of probability. **Statistically different from zero at 1-percent level of probability.

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[12] The average earnings-price ratio (or net rent-to-land price ratio) was calculated by dividing landlord net real estate income per acre by real estate sale price per acre.

[13] Any other straight line drawn through the dots will increase the "sum of the squared errors" and, hence, result in a poorer fit. Each "squared error" is the square of the vertical distance between a dot and the line of best fit, most often a sloping line.

[14] That is, the true value (slope of the regression line) would be zero in less than 1 chance in 20.

differently, buyers paid these amounts for the right to receive an additional dollar of net income. Therefore, the net land rent-to-land price ratios implied by these simple regression values are 5.2 percent in the grain area (\$1.00 divided by \$19.33), 1.8 percent in Douglas County (\$1.00 divided by \$56.88), and 9.7 percent in Marion County (\$1.00 divided by \$10.29).

These percentages differ from the average earnings-price ratios mentioned earlier—4.3 percent in the grain area, 1.0 percent in Douglas County, and 2.8 percent in Marion County. The reason for these differences is that the average earnings-price ratio implies that this stated percentage return will be earned on the investment irrespective of the level of net income per acre. (With zero net income, the tract would have a selling price of zero. See figure 3.) On the other hand, the ratio implied from the regression value is valid only at the mean (weighted average) value of the income variable (X_6) and varies in value as the level of income varies. That is, when the regression line intersects the vertical axis it is flatter than the line running from the origin, so the ratio will be smaller at lower levels of earnings and larger at higher levels of earnings.[15]

Even though a property may generate no net real estate income, it will still command a price in many markets, particularly in nonagricultural influenced markets. The rationale for this is that many purchasers of farm property do not consider annual net real estate income the only benefit derived from owning farm property. Other benefits may be potential for realizing capital gains as a result of land price appreciation, living in a rural setting, and enjoying outdoor recreation activities on or near the property.

By dividing the value of the coefficient on the year of sale variable (X_1) by the mean sale price of farm real estate in each area, the annual rate of land price change over the study period can be approximated. The coefficient values are significant only in the two areas characterized as nonagricultural influenced. In the grain area the -3.02 value indicated that over the period 1965-69 farm real estate price per acre *decreased* on the average \$3.02 per year. However, this value was not significantly different than zero; that is, there was no significant linear trend in farm real estate prices during 1965-69 in the grain study area.[16] In urban-recreation influenced

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[15] Both lines pass through the mean of the independent (income) variable at the mean of the dependent (sale price) variable. But since the regression line intersects the vertical axis at a positive value, it is flatter than the line from the origin (fig. 3).

[16] High grain prices during 1972 and 1973, however, caused a sharp upturn in dry farmland prices in this area.

COMPARISON OF EARNINGS—PRICE RATIOS

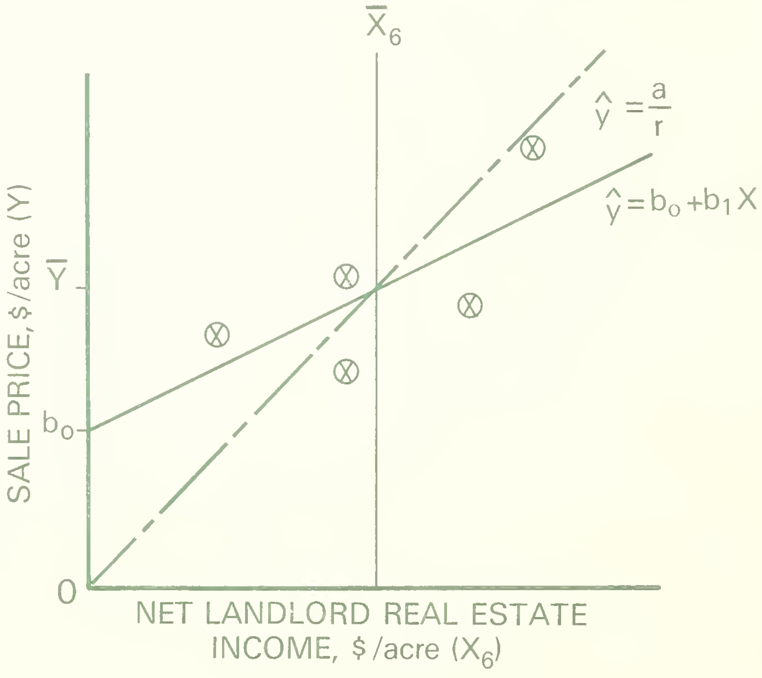

Figure 3

Douglas County farmland prices increased a substantial 14.3 percent per year ($33.92 divided by $237.32).[17] In urban influenced Marion County the rate of appreciation was almost as sharp—12.1 percent ($79.01 divided by $654.80). One would not obtain an appropriate indication of the total annual percentage return to farm real estate in an area by simply adding the annual percentage return based on net income to the annual percentage increase in farm real estate prices in that area. However, in most instances this procedure would result in only a moderate overstatement of the actual percentage return. The actual rate of return can be determined, though, by using a modified income capitalization formula which solves for the present value of return from rent and sale proceeds.[18]

The expected value of the building variable (X_3) was 1.0. This would indicate that a $1 increase in the assessed value of buildings per acre would correspond with a $1 increase in the sale price of farm real estate (land and buildings) per acre. However, the coefficient values on the building variable by areas were 0.55 in the grain area, 2.68 in Douglas County, and 1.41 in Marion County. The value in the grain area, while not significant, showed that each dollar of assessed building value added only $0.55 to selling price. In the other two areas, where the values were significant, each dollar of assessed building value added considerably more than $1 to selling price—$2.68 in Douglas County and $1.41 in Marion County.

Studying the correlation between farmland prices and each of several variables or factors individually can lead to a fuller understanding of the importance of various possible price influencing factors in one or more farmland markets. It is straightforward and the results are fairly easy to understand and interpret. But while simplicity is an advantage of this approach, it is also a shortcoming. That is, two or more "independent" variables (say, building value per acre and miles to a population center) may "explain" the same variation in farmland prices. However, it is not possible to measure interaction between independent variables using simple regression analysis. Conclusions based on simple regression coefficient values may thus understate or overstate the importance of a property characteristic in explaining variation in farmland prices.

Net Regression Coefficient Values

A multiple regression model was used to analyze the same farmland sales data. This was done primarily to overcome shortcomings of the simple regression model. Also, it provided an alternative method of analyzing the apparent relevance of each of the six variables in the model. Thus, the difference between the net regression coefficient value and simple regression value could be compared for each variable in each area.[19] The net regression coefficient values are shown in table 3.

Table 3.—Net regression coefficients, standard errors of the coefficients, and multiple correlation coefficient values, by area

Real estate characteristic	Grain area	Douglas County	Marion County
X_1 (year of sale, 1965-69)	0.20 (1.99)	30.50** (6.48)	62.61* (24.54)
X_2 (acres in sale)	-0.007* (0.004)	-0.013 (0.014)	-1.09* (0.45)
X_3 (assessed value of buildings, $/acre)	1.47* (0.68)	2.27** (0.16)	1.34** (0.18)
X_4 (miles to nearest paved road)	-2.82* (1.38)	4.02 (5.84)	-155.40** (67.65)
X_5 (miles to nearest town ⩾ 1,000 population) .	0.38 (0.19)	1.60 (1.56)	-6.10 (9.13)
X_6 (landlord net real estate income, $/acre)	17.11** (1.90)	49.71** (3.39)	-0.51 (2.65)
R^2 (percent)	69.04	79.60	51.82

*Statistically different from zero at 5-percent level of probability. **Statistically different from zero at 1-percent level of probability.

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[17] This implied rate of increase holds only at the mean of the year of sale variable. For years earlier in the study period the implied rate would be greater because the constant annual dollar increase is divided by lower average priced property. Conversely, for years later in the study period the implied rate would be less because of higher average priced property.

[18] The general form of the modified income capitalization formula and a numerical example are shown in appendix B.

[19] The interpretation given to a net regression coefficient value is that if the size of a particular variable is increased by one unit (year, acre, dollar, or mile), sale price per acre will be changed by the value of the coefficient. The average size of all other variables is assumed to remain constant.

Assessed value of buildings per acre (X_3) was the only significant variable in all three areas. The value in each area exceeded 1.0, indicating that an additional dollar's worth of assessed building value would add more than $1 to sale price.

Miles to the nearest town of at least 1,000 population (X_5) was, unexpectedly, not a significant variable in any area. This variable or property characteristic was expected to be particularly important in explaining differences in farmland prices in urban influenced Marion County, and perhaps in urban-recreation influenced Douglas County. But other variables in the model appeared to explain the variation in land prices in these areas.

Miles to the nearest paved road (X_4) was a significant variable in Marion County and had a very large value, -155.40. But since the mean distance to the nearest paved road averaged less than one-quarter mile for Marion County sales (table 1), this value should perhaps be viewed as a $15.54 decrease in price per acre for a property located an additional one-tenth mile from a paved road. This variable was also significant in the grain area, but price dropped only $2.82 per acre for property located 1 mile further than the average 2.02 miles from a paved road. The variable was not significantly different from zero in Douglas County where properties averaged 0.82 mile from the nearest paved road.

The acreage variable (X_2) was significant in the grain area and Marion County. However, the values of the coefficients were relatively small–less than $0.01 and $1.09 per acre, respectively. And in each area, the net regression coefficient value on the acreage variable was considerably smaller than the simple coefficient value. In Marion County, for instance, the net regression coefficient value on the acreage variable was only -$1.09, compared with the simple regression coefficient value of -$1.88.

Net regression coefficient values on the year of sale variable (X_1) were similar in size to the simple regression values in all three areas. The value in the grain area remained insignificant and low ($0.20 per year), while values in Douglas and Marion Counties were significant and large ($30.50 and $62.61 per year, respectively). Average annual rates of land price appreciation implied from these values were 0.2 percent in the grain area ($0.20 per acre annual land price increase divided by $105.69 per acre mean sale price), 12.9 percent in Douglas County ($30.50 divided by $237.32), and 9.6 percent in Marion County ($62.61 divided by $654.80).

Net regression coefficient values on the net real estate income variable (X_6) were of particular interest. The $17.11 value for the grain area was significant and implied a net rent-to-land price ratio of 5.8 percent ($1.00 increase in net income per acre divided by $17.11 increase in sale price per acre). Such a moderate rate was expected in the primarily agricultural influenced grain area. The $49.71 value in urban-recreational influenced Douglas County was nearly three times larger than the value in the grain area and implied a 2.0 percent rent-to-price ratio. But even though this ratio was very modest, the coefficient value was significant. This would suggest that the level of expected net real estate income was an important consideration of successful bidders when formulating their offering prices for farm property in this area, even though they generally paid considerably higher prices than would be justified by net rents alone.

The most unexpected net regression coefficient value was the -0.51 value on the net income per acre variable (X_6) in Marion County. This value indicates that if net real estate income per acre were increased $1, sale price per acre would decrease $0.51. This value was not significantly different than zero, however, which indicated that no significant relationship existed between income per acre and sale price per acre. But this relationship suggested need for scrutiny of Marion County sales data, the model, and assumptions used. After review of these possible sources of error, two factors appeared responsible for the unexpected coefficient value on the income variable in Marion County. One was the strong correlation (r=0.66) between building value per acre (X_3) and sale price per acre (Y).[20] The other was the assumption that, in this area only, annual gross building income would be 10 percent of assessed value.

The assessed value of buildings amounted to only one-fifth (19.5 percent) of the total value of land and buildings for the sales analyzed in Marion County. But variation in building value per acre "explained" over 43 percent of the variation in sale price per acre in this area (appendix C). The other five variables explained an additional 8.4 percent, of which the income variable explained less than one-tenth of 1 percent. However, because of the close correlation (r=0.58) between the building value variable (X_3) and income variable (X_6), it appeared that the income variable could have explained much of the variation in sale price per acre explained by the building variable (appendix A). For this reason, certain modifications of the basic six-variable model were made and the Marion County sales data were reanalyzed.

The first revision of the model involved deleting the building value variable (X_3). As expected, the coefficient value on the real estate income variable became positive (11.59). But unexpectedly, the coefficient value changed from insignificant to significant. However, this five-variable revised model explained only 28.9 percent of the variation in real estate sale price per acre, compared with 51.8 percent for the original six-variable model (appendix D).

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[20] Values of r near zero indicate little association between two variables, whereas values of r near -1 or 1 indicate a high degree of association or correlation (see *9*, pp. 185-6).

In the second revision of the model, the dependent variable was changed from sale price of real estate (land and buildings) to sale price of *land* (bareland) per acre. This involved deducting the assessed building value, if any, from the sale price of each property, and not including the estimated gross income and expenses attributed to buildings in the income variable for each property. This revised model gave fairly poor results. The coefficient value on the land income variable was negative (-1.72) and insignificant, and the model explained only 14.5 percent of the variation in sale price of land per acre. Both revised models explained less of the variation in sale price per acre than the original model. Therefore, to gain additional insight into how the selected property characteristics affected real estate prices in Marion County, sales were stratified according to size, source of net real estate income, and whether the property had building value. Results of these analyses and additional analyses of sales from the other two areas are shown in appendix D.

Of the additional six equations involving stratified Marion County sales, the income variable was significant (but at the 10-percent level) in only one. This equation, M8, involved sales from which less than 50 percent of the gross real estate income (land and building rent) represented rent from irrigated-tilled land. (Other categories of land were nonirrigated-tilled, irrigated-nontilled, and nonirrigated-nontilled.) Three of the six equations, however, implied a rate of price increase above the 9.6 percent implied in the original model involving all sales in the area. The rate was also significant at the 5-percent level in each area. The implied rate of increase, at the mean, was 13.8 percent for sales of less than 30 acres, 15.8 percent for sales where less than 50 percent of the gross real estate income was from irrigated and tilled land rent, and 21.0 percent for sales with no assessed building value.

Miles to a paved road (X_4) was a more valuable property characteristic for the category of sales "less than 30 acres," and also for "sales with no assessed building value." These results, and the wide variation in regression values on other variables in the equations involving stratified sales, suggest that motives for real estate ownership are much more heterogeneous in urban influenced areas, such as Marion County, than in the other types of areas analyzed. That is, there are obviously numerous motives for purchases of rural property in and near rural-urban fringes in addition to agricultural income generation. But purchases motivated by other than agricultural income generation usually remain in an agricultural use, so the diversity of motives for land ownership within and among areas is usually not readily apparent.[21] It may be that before more fruitful analysis of transactions is possible in this type of area, purchases will need to be stratified according to primary motive for purchase.[22]

To review briefly, three study areas were selected in the belief that each would represent a separate land market. However, it appears that several separate land markets exist within the urban influenced area. So, while the level of net real estate income does not appear to be an important influence on farmland prices for all sales taken collectively in urban influenced Marion County, income may be a very important influence on prices paid for purchases primarily for agricultural use. Care must be taken, therefore, not to misinterpret or "overinterpret" the value on the income variable in Marion County.

Comparison of Coefficient Values on Corresponding Variables Among Areas

The multiple regression routine solved for the value and significance level of net regression coefficients in each area (table 3). However, results of this analysis could not be used directly to test the null hypothesis that the quantitative values of corresponding net regression coefficients do not differ significantly among areas. To test this hypothesis, a 95-percent confidence interval was constructed around each value (table 4).[23] Confidence intervals around corresponding net regression coefficients were then checked for overlapping. If confidence intervals on corresponding variables among areas overlapped, the null hypothesis would not be rejected and it would be concluded that corresponding net regression coefficients did not differ significantly among the study areas. Overlapping confidence intervals are indicated by brackets in table 4.

All possible variations in extent of overlapping occurred. Confidence intervals on the variable "distance

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[21] Obvious exceptions are land purchased for subdivisions, industrial parks, and other construction sites—unless the purchases are for speculative purposes. In that case, land use may not change for years.

[22] Commonly mentioned motives for farmland purchases include farm enlargement, rural residence, part-time farming (including hobby farms and farms used for tax loss purposes), recreational use, long-term investment (as a hedge against inflation), and speculation.

[23] This procedure was used in a study (6, p. 80) of regional factors affecting farmland values in Illinois.

Table 4—Confidence intervals of net regression coefficient values, corresponding variables, by area

Area	X_1	X_2	X_3
Grain	-3.73, 4.18	-0.015, 0.001	0.11, 2.83
Douglas Co.	17.54, 43.46	-0.041, 0.015	1.95, 2.59
Marion Co.	13.53, 111.69	-1.99, -0.19	0.93, 1.70

Area	X_4	X_5	X_6
Grain	-5.58, -0.06	0.00, 0.76	13.31, 20.91
Douglas Co.	-7.66, 15.70	-1.52, 4.72	42.93, 56.49
Marion Co.	-290.70, -20.10	-24.36, 12.16	-5.81, 4.79

Brackets around numbers signify overlapping 95-percent confidence intervals.

Variable identification:

X_1 = Year of sale, 1965-69

X_2 = Acres in sale

X_3 = Assessed value of bldgs, \$/acre

X_4 = Miles to nearest paved road

X_5 = Miles to nearest town ≥ 1,000 population

X_6 = Landlord net real estate income, \$/acre

to a town of at least 1,000 population" (X_5) overlapped for all pairwise comparisons. But this reflected more the extreme width of the confidence intervals than the closeness of net regression values among areas. At the other extreme, no overlapping of confidence intervals occurred among areas on the net real estate income variable (X_6). Two factors responsible for this appear to have been the vastly different indicated impact on farmland prices among areas of a \$1 increase in net income, and the relatively narrow confidence interval around the net regression coefficient value in each area (table 3). Some overlapping occurred among areas on each of the other four variables. It was therefore concluded that corresponding net regression coefficient values on all variables, except distance to a town of 1,000 (X_5) differed significantly among areas. And as a consequence of these findings, it was concluded that variously influenced farmland markets do exist.

Comparison of Current and Prudent-Investor Rates of Return

To test whether a disparity existed between the farm use value and current market value of farmland in any study area, the mean rate of return in each area was compared with a prudent-investor rate of return. The prudent-investor rate of return selected was 6 percent.[24]

Table 5—Mean rate of return, standard deviation of mean, and 95-percent confidence interval around mean rate of return, by area

Area	Mean rate of return	Std. Dev. of mean	Approximate 95% conf. interval($\bar{r} \pm 2s_{\bar{r}}$)
Grain	4.3%	± 1.6%	1.1 to 7.5%
Douglas Co.	1.0%	± 1.0%	-1.0 to 3.0%
Marion Co.	2.8%	± 1.9%	-1.0 to 6.6%

There were substantial differences in the mean rates of return on the sale price of property among the three areas studied, but the rate was substantially below a prudent-investor rate in all areas (table 5). To test whether the mean rate of return in any area was significantly different from 6 percent, variation in individual rates of return in each area was taken into account. That is, a 95-percent confidence interval was established around the indicated mean rate of return in each area. In addition to the mean rate of return ($\bar{r}$), the standard deviation of the mean ($s_{\bar{r}}$) and approximate 95-percent confidence interval ($\bar{r} \pm 2s_{\bar{r}}$) are given in table 5 for each area's mean rate of return. These data were used to test the null hypothesis that the mean rate of return on the purchase price of property was equal to the prudent-investor rate of return in each area. That is, the null hypothesis,

$$H_o: \bar{r}' = \bar{r}'' = \bar{r}''' = \bar{r}^p$$

was tested against the alternative hypothesis,

$$H_a: \bar{r}' \neq \bar{r}'' \neq \bar{r}''' \neq \bar{r}^p$$

where,

$\bar{r}'$ = mean rate of return in the grain area,

$\bar{r}''$ = mean rate of return in Douglas County,

$\bar{r}'''$ = mean rate of return in Marion County, and

$\bar{r}^p$ = prudent-investor rate of return (6 percent).

Overlapping of 95-percent confidence intervals in all pairwise area comparisons indicated that the mean rate of return on the purchase price of property did not differ significantly among areas. However, the confidence interval for Douglas County did not include the prudent-investor rate of return (6 percent). Therefore, the null hypothesis was rejected, the alternative hypothesis was accepted, and it was concluded that the mean rate of return in all areas was not equal to the assumed prudent-investor rate of return. Thus, despite the relatively low mean rate of return in all three areas studied, it was concluded that a disparity between farm use and current market values of property existed only in urban-recreation influenced Douglas County. But the wide range of rates of return within each area supports the belief that considerations in addition to the level of expected net real estate income from the tract purchased influenced prices paid for properties in each area.

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[24] A higher rate may be appropriate now in light of the increase in long-term interest rates on alternate investments since this study was conducted.

IMPLICATIONS–DIFFERENT FARMLAND MARKETS EXIST

The influence of anticipated net rents on property values and the net rent-to-land value ratios varied among the types of areas analyzed in this study. These results were accepted as evidence supporting the existence of several types of agricultural land markets. The relative importance of the three main motives for land ownership–realization of net rents, enjoyment of esthetic qualities of the property, and realization of capital gains at time of resale–varies among types of land markets. That is, the most important motive for land purchase by type of area is expected to be: net rents in primarily agricultural production areas, esthetic qualities of land in the recreation and urban-recreation areas, and capital gains in the urban influenced areas, as a result of more intensive use of or change in use of land. It is thus inappropriate to treat various concerns–such as land tenure, land use, assessment procedures, mortgage financing, and agricultural policy–as if they related to a homogeneously influenced land market.

Because of the strong evidence that several types of farmland markets exist, studying land use and other concerns on a type-of-area basis holds considerable promise for improving forecasts and analyses of these concerns. Since the price of many rural tracts no longer reflects the agricultural productivity values of land, changes in any number of factors that affect land will have a differential impact on land use and land values in each type of land market.

The overall land market should be delineated into smaller land markets involving more homogeneous types of properties and more homogeneously motivated participants. This would involve identifying the acreage around population centers and the acreage with recreation or other esthetic qualities in which current market prices of farmland exceed farm-use or productivity values by a substantial margin. For some purposes, it may be beneficial to split the remaining land–the land whose value is believed to be based primarily on its productive capabilities–into various use categories. Major agricultural land use categories would include irrigated-cultivated, nonirrigated-cultivated, grazing or pasture, and groves or vineyards.

Even though considerable research on land value and related concerns continues to be conducted, many questions remain concerning the level and movement of land values over time. There are at least two explanations for this knowledge gap. One is that land values and land market developments have not been analyzed in an appropriate framework. The other (or perhaps only an extension of the first) is that the nature of many land markets changes over time–that is, the absolute or relative importance of factors affecting land markets change. Each explanation appears to have some validity, but neither contains prescription for improvement. We must incorporate the concept of variously influenced farmland markets into future analyses of farm real estate market developments. As analysts (lenders, investors, assessors, researchers, and others) find empirical support for the idea that the relative importance of various price-influencing factors varies among agricultural areas and over time, decisions affecting many farmland-related issues should improve. The research reorientation proposed will probably not lessen the need for analyses of farm real estate market developments. But it should lessen the mysticism surrounding the land pricing process.

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Appendix A—Matrix of simple correlation coefficients, by study area[1]

	X_1	X_2	X_3	X_4	X_5	X_6	Y
Grain Area							
X_1	1.00	0.04	-0.18	-0.03	-0.12	-0.09	-0.11
X_2	—	1.00	0.15	-0.23	-0.26	-0.43	-0.44
X_3	—	—	1.00	0.06	0.02	-0.09	0.06
X_4	—	—	—	1.00	0.34	0.04	-0.02
X_5	—	—	—	—	1.00	0.29	0.35
X_6	—	—	—	—	—	1.00	0.79
Y	—	—	—	—	—	—	1.00
Douglas County							
X_1	1.00	-0.08	0.08	0.02	-0.29	-0.03	0.21
X_2	—	1.00	-0.20	-0.08	0.03	-0.18	-0.27
X_3	—	—	1.00	-0.02	-0.02	0.14	0.66
X_4	—	—	—	1.00	0.16	0.03	0.05
X_5	—	—	—	—	1.00	0.01	-0.02
X_6	—	—	—	—	—	1.00	0.65
Y	—	—	—	—	—	—	1.00
Marion County							
X_1	1.00	-0.01	0.07	0.01	-0.04	-0.23	0.23
X_2	—	1.00	-0.20	-0.07	0.12	-0.06	-0.28
X_3	—	—	1.00	0.01	0.03	0.58	0.66
X_4	—	—	—	1.00	0.14	-0.11	-0.14
X_5	—	—	—	—	1.00	-0.07	-0.07
X_6	—	—	—	—	—	1.00	0.34
Y	—	—	—	—	—	—	1.00

where,

X_1 = Year of sale, 1965 through 1969
X_2 = Acres in sale
X_3 = Assessed value of bldgs, \$/acre
X_4 = Miles to nearest paved road
X_5 = Miles to nearest town $\geqslant$ 1,000 population
X_6 = Landlord net real estate income, \$/acre
Y = Sale price, \$/acre (land and bldgs.)

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[1] The multiple correlation coefficient value (r^2), a measure of the proportion of the variation about the mean (real estate price per acre) explained by the simple regression, is determined by squaring the simple correlation coefficient value (r) shown above (4, p. 26).

APPENDIX B–MODIFIED INCOME CAPITALIZATION FORMULA[1]

The general form of the modified income-capitalization formula developed which incorporates possible increases in net rents and/or the value of a property is presented below:

$$V'_{t_o} = \sum_{t=1}^{n} \left[\frac{a_t}{(1+r)^t} \right] + \frac{V_{t_{o+n}}}{(1+s)^n}$$

where: V'_{t_o} = value the purchaser could afford to pay for the property, given the following values.

a_t = The annual net rent. [If the level of net rent is expected to change "g" percent per year, this term would be replaced by $a_o (1+g)^t$, where a_o is the level of net rent at the beginning of year 1.] Rents assumed to be received at end of year.

r = rate used to discount future net rents

$V_{t_{o+n}}$ = expected market value of the property at the end of year n. [If this price is assumed to reflect a constant annual percentage change, h, over the purchase price, $V^o_{t_o}$, this term would be replaced by $V^o_{t_o} (1+h)^n$.]

s = rate used to discount the reversion or future selling price. May equal "r."

The following Iowa farmland rent and land value data are used to work through an example using the modified formula.

Capital Growth and Earnings Data - Iowa Farmland, 1962-72[2]

Year	Per $1,000 Invested January 1, 1962		
	Value January 1	Net rent	Rent-to-value ratio (percent)
1962	$1,000	$40	4.0
1963	1,021	44	4.3
1964	1,063	46	4.3
1965	1,122	52	4.6
1966	1,236	54	4.4
1967	1,397	52	3.7
1968	1,527	61	4.0
1969	1,582	63	4.0
1970	1,612	64	4.0
1971	1,624	70	4.3
1972	1,667		
Net earnings Jan. 1962-72	$667	$546	

Use of the Iowa Farm Land Data in the Modified Income Capitalization Formula[2]

$$V_{t_o} = \sum_{t=0}^{n-1} \left[\frac{a_t}{(1+r)^t} \right] + \frac{V_{t_{o+n}}}{(1+s)^n}$$

$$\$1{,}000 = \frac{\$40}{(1+r)^0} + \frac{\$44}{(1+r)^1} + \ldots + \frac{\$70}{(1+r)^9} + \frac{\$1{,}667}{(1+s)^{10}}$$

Substituting 10.0 percent for both "r" and "s", a property value of $995 is implied. The calculations are shown below. (A 9.5 percent discount rate implied a $1,032 property value.)

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[1] See (*2*) for a discussion of this formula's development.

Year	Earnings or sale price	Discount factor[3]	Discounted present value
1962	\$40	$1/(1.10)^{0} = 1.0000$	\$40.00
1963	44	$1/(1.10)^{1} = .9091$	40.00
1964	46	$1/(1.10)^{2} = .8264$	38.01
1965	52	$1/(1.10)^{3} = .7513$	39.07
1966	54	$1/(1.10)^{4} = .6830$	36.88
1967	52	$1/(1.10)^{5} = .6209$	32.29
1968	61	$1/(1.10)^{6} = .5645$	34.43
1969	63	$1/(1.10)^{7} = .5132$	32.33
1970	64	$1/(1.10)^{8} = .4665$	29.86
1971	70	$1/(1.10)^{9} = .4241$	29.69
1972	1,667	$1/(1.10)^{10} = .3855$	642.63
			\$995.19

[2] Based on Iowa State University surveys (7, p. 3). [3] Rents assumed to be received at beginning of year.

Appendix C—Summary table of basic stepwise regression model results, by area of study: Order of variable entry, and F-level and R^2 value after each entry

	Step No.	Variable entered	d.f.	F-level	R^2
Grain Area:	1	6	72	121.77	0.628
	2	3	71	3.44	0.646
	3	2	70	3.37	0.662
	4	4	69	2.21	0.672
	5	5	68	3.95	0.690
	6	1	67	0.01	0.690
Douglas County:	1	3	144	111.35	0.436
	2	6	143	192.42	0.760
	3	1	142	22.21	0.792
	4	5	141	1.32	0.794
	5	2	140	0.91	0.795
	6	4	139	0.47	0.796
Marion County:	1	3	117	89.67	0.434
	2	1	116	7.11	0.467
	3	2	115	5.54	0.491
	4	4	114	5.93	0.516
	5	5	113	0.43	0.518
	6	6	112	0.04	0.518

Variable Identification:
X_1 = Year of sale, 1965-69
X_2 = Acres in sale
X_3 = Assessed value of buildings, dollars per acre
X_4 = Miles to nearest paved road
X_5 = Miles to nearest town of at least 1,000 population
X_6 = Landlord net real estate income, dollars per acre

APPENDIX D–Multiple regression analysis results, by area

Area	Model	Description of Model		X_1	X_2	X_3	X_4	X_5	X_5^a	X_6	X_6^a	X_7	R^2	S	$\bar{Y}$
Grain:	G1	Basic 6-variable model (74 sales)	Y = 27.38[a]	0.20[b] (1.99)[c]	-0.007* (0.004)	1.47* (0.68)	2.82* (1.38)	0.38# (0.19)		17.11** (1.90)			0.690	2.79	105.69 (41.34)[d]
	G2	Miles to nearest town (X_5^a) substituted for X_5	Y = 44.31	0.36 (1.95)	-0.006# (0.004)	1.38* (0.66)	-0.51 (1.40)		-1.58** (0.60)	16.92** (1.85)			0.703	2.73	105.69 (41.34)
	G3	Add-on variable (X_7) added to basic 6-variable model	Y = 24.34	0.09 (2.02)	-0.007# (0.004)	1.48* (0.68)	-2.87* (1.39)	0.40* (0.20)		16.99** (1.93)		4.14 (9.19)	0.691	2.79	105.69 (41.34)
Douglas Co.	D1	Basic 6-variable model (146 sales)	Y = -173.32	30.50** (6.48)	-0.013 (0.014)	2.27** (0.16)	4.02 (5.84)	1.60 (1.56)		49.71** (3.39)			0.796	8.16	237.32 (213.75)
	D2	Miles to Roseburg (X_5^a) substituted for X_5	Y = -147.06	28.41** (6.61)	-0.012 (0.014)	2.27** (0.16)	5.00 (5.81)		-0.04 (0.07)	49.73** (3.40)			0.795	8.19	237.32 (213.75)
Marion Co.	M1	Basic 6-variable model (119 sales)	Y = 178.86	62.61* (24.54)	-1.09* (0.45)	1.34** (0.18)	-155.40* (67.65)	-6.10 (9.13)		-0.51 (2.65)			0.518	24.19	654.80 (370.44)
	M2	Miles to Salem (X_5^a) substituted for X_5	Y = 115.42	65.06* (24.79)	-1.15* (0.45)	1.32** (0.18)	-161.44 (67.13)		1.14 (3.87)	-0.42 (2.67)			0.517	24.23	654.80 (370.44)
	M3	Bldg. value (X_3) deleted	Y = -224.48	109.76** (28.64)	-1.77** (0.54)		-122.89 (81.64)	1.93 (10.97)		11.59** (2.51)			0.289	29.26	654.80 (370.44)
	M4	Sales adjusted to bareland i.e., $Y^a = Y$ - bldg. val/ac; $Y_6^a = X_6$ - bldg. income and expenses/ac.	Y^a = 245.52	62.25* (25.81)	-1.26** (0.47)		-131.11 (71.26)	-5.17 (9.66)			-1.72 (2.76)		0.145	25.60	536.41 (295.56)
Stratified Sales	M5	≥ 30 acres (57)	Y = 351.96	39.06 (33.08)	-0.44 (0.59)	0.97* (0.38)	-139.80 (97.78)	-20.91 (13.32)		1.05 (3.88)			0.276	33.70	540.30 (282.58)
	M6	< 30 acres (62)	Y = 51.09	103.40** (36.90)	-14.20* (6.38)	1.30** (0.22)	-242.41* (95.17)	10.04 (13.00)		0.33 (3.78)			0.637	33.12	760.06 (410.65)
	M7	≥ 50% of gross R.E. income from irr-till land rent (41)	Y = 635.79	12.94 (26.25)	0.06 (0.43)	0.95** (0.30)	-160.13# (80.83)	-15.89 (9.71)		-4.88 (4.66)			0.367	24.29	548.80 (180.12)
	M8	< 50% of gross R. E. income from irr-till land rent (78)	Y = -253.82	111.89** (33.23)	-2.35** (0.67)	0.58 (0.40)	-166.46# (89.93)	4.10 (12.27)		14.56# (7.31)			0.593	32.31	710.51 (429.31)
	M9	Sales with no assessed bldg. value (47)	Y = -8.63	113.15* (52.37)	-2.09# (1.07)		-200.02 (143.96)	26.94 (21.54)		1.70 (5.23)			0.255	45.35	538.45 (340.23)
	M10	Sales with assessed bldg. value (72)	Y = 72.99	42.44 (25.13)	-0.10 (0.49)	1.56** (0.19)	-92.92 (72.12)	1.17 (8.95)		2.13 (3.02)			0.684	25.74	730.75 (371.82)

[a] Constant value. [b] Partial regression coefficient. [c] Standard error of partial regression coefficient. [d] Standard deviation of Y.

Identification of symbols:

Y = Real estate sale price, \$/ac. (land and bldgs.)
Y^a = Sale price of land, \$/ac. (land only)
X_1 Year of sale, 1965-69
X_2 Acres in sale
X_3 Assessed value of bldgs., \$/ac.
X_4 Miles to nearest paved road

X_5 = Miles to nearest town ≥ 1,000 population
X_5^a = Miles to: Nearest town supplying daily needs (grain area), Roseburg (Douglas County), or Salem (Marion County)
X_6 = Landlord net real estate income, \$/ac.
X_6^a = Landlord net land income, \$/ac.
X_7 = Add-on, i.e., 1 if farm enlargement purchase, 0 otherwise

R^2 = Multiple regression coefficient
S = Standard deviation of Y for $X_i = \bar{X}_i$
$\bar{Y}$ = Mean value of dependent variable/ac. (land and bldgs, or land only)
** = Statistically different from zero at 1
* = Statistically different from zero at 5
# = Statistically different from zero at 10

Source (3, p. 175)

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